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CORRELATED DENTO-FACIAL PROGRESSION AND THE ORIGIN OF MAN

ABSTRACT: The extreme variation in dento-facial morphology in Australopithecus *opens the question of determining the first evidence of the* Homo *lineage. The most primitive species, Weinert's (1950)* Meganthropus africanus *and* Australopithecus anamensis *are morphologically most similar to* Australopithecus afarensis. *However they are characterized by a primitive suite of dento-facial characters maintained in* Homo *but absent in* A. afarensis. *The premaxillary lengthening in* A. afarensis *and the high position of the anterior masseter origin in* A. africanus – A. robustus – A. boisei *are derived positions.* Homo *therefore emerged close to* Meganthropus africanus *and* A. anamensis, *more than 4 Myr ago.*

KEY WORDS: Hominids – "Hominity" – Dento-Facial morphology

The primordial aim of palaeoanthropological research in Africa and Asia was to answer these questions: Who is man's ancestor? Is there an actual separation between man and his direct ancestor?

Up to now many early hominids, named australopithecines, have been discovered and at least six species are clearly identified. But their analysis reveals such a complexity of specialised characteristics that until today it has been impossible to recognize unambiguously the "arrival" of our direct ancestor. The latest *Australopithecus* to be recognized, *A. anamensis*, is as a matter of fact the first one enabling us to classify more clearly the adaptations observed and consequently to determine what separates, these early hominids from genus *Homo* we belong to (Leakey *et al.* 1995).

A FUNCTIONAL ADAPTATION

Monkeys are the only mammals with constant prehension in the arboreal walk as well as during the manual operations of the sitting position. This feature is bound to quadrumany (the thumbs of their hands and the big toes of their feet enable them to grasp). Early hominids present a progressive liberation since it has been admitted that the oldest species, *Ardipithecus ramidus*, walked in a bipedal position though they still frequently climbed trees. Arising bipedalism in successive species of australopithecines: *A. anamensis*, *A. afarensis*, *A. africanus*, *A. aethiopus*, *A. robustus*, and *A. boisei* is becoming unquestionable in *Homo*.

The jaws and teeth of *Australopithecus* show differences in diet and dietary breadth from *Homo*. The biped born in the forest abandons partially leaves and fruits from tree-tops and turns to plant seeds and ground food. The australopithecines had therefore accelerated tooth damage and developed the necessary protections so as not to be reduced to eating with their gums or starving to death. So in the australopithecines, molars and premolars of the various species have become more and more important, between 4.4 to 1.5 million years (Myr) ago, from *Ardipithecus* to *A. boisei*. Since the most archaic species, *Ardipithecus*, had teeth whose enamel was thinner than the one of *Australopithecus*, we can imagine that arising bipedalism acquired in the forest was for a certain period

bound to a change in food. As a matter of fact, the thickness of enamel in extant primates depends on the strain applied to the dental surfaces and we observe that the thickened layers always correspond to the most used areas to split food. This process which produces the thickest layer where the wear is the fastest has produced in the various australopithecines a continually growing thickness of enamel in the successive species.

AN EVOLUTIVE ADAPTATION

Primate skull differs from the one of other mammals in having a lesser development of the face compared to brain cavity. This feature increases in its evolutionary course, and the australopithecine skull is liberated from some of the muscular mass which then is sufficient to maintain its balance at the top of the spinal chord.

Garusi hominid from Laetoli, Weinert's (1950) *Meganthropus africanus*, and the recently described early hominid *A. anamensis*, dated 3.5 to 4.1 Myr, are the more primitive australopithecines. They are also a paraphyletic group more directly intermediate between fossil apes and *Homo*. The species presents a remarkable combination of primitive features: the tooth rows are nearly parallel and close together and the palate is narrow and shallow. A relatively large P3 compared to P4, indicates that the apomorphic condition of molarisation in further australopithecines is not present. Canines have long robust roots and, since they are placed more vertically, the lower lateral margins of the piriform aperture appear to be more vertical with the facial skeleton less posteriorly inclined than in *A. afarensis*.

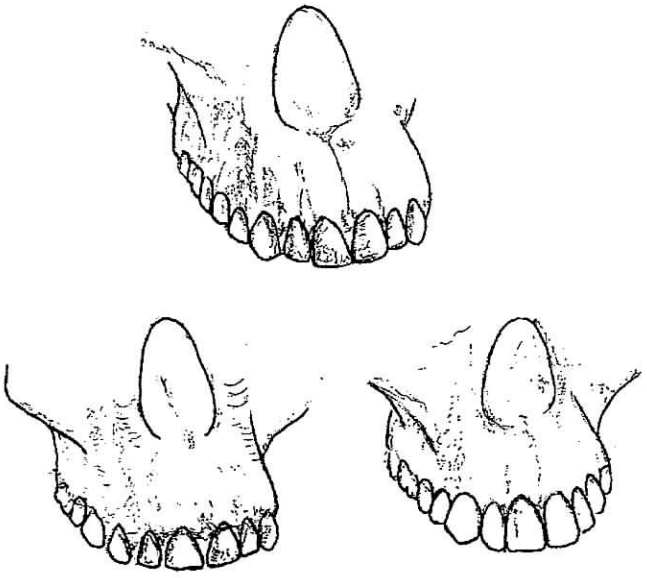
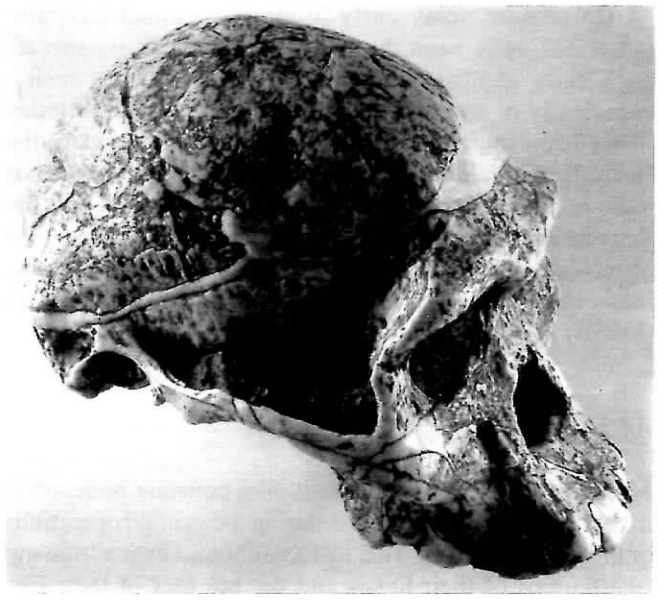


FIGURE 1. Above: The maxilla in *Australopithecus afarensis* is snout shaped and resembles Pan in its projection. Left: The nasoalveolar prognathism is smaller in *Australopithecus africanus* and the masseter origin is in a high position. Right: *Meganthropus africanus* from Garusi, perhaps ancestral to *A. afarensis*, prefigure the nasoalveolar morphology of *Homo*.

FIGURE 2. The upper jaw of *Meganthropus africanus* Garusi Hominid, 4 Myr, placed on *Homo habilis* Olduvai Hominid 7, 1.8 Myr

Homo is characterized by an important increase in brain volume and a weakening of dental apparatus. These

FIGURE 3. *Australopithecus africanus*, Sts 5:3 Myr, postdating *Meganthropus africanus* and *A. afarensis*, is in the morphological direction of the robust australopithecines (White *et al.* 1981).



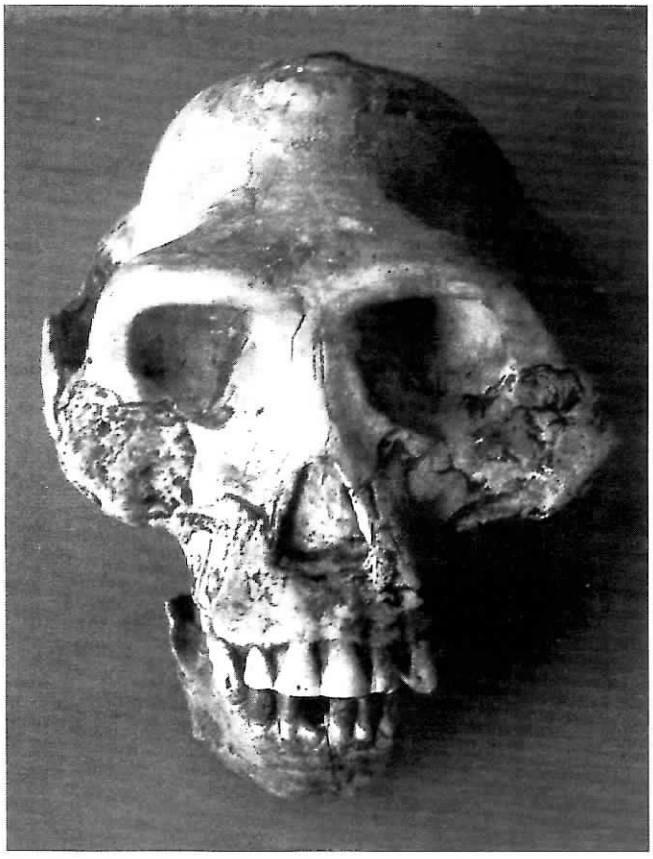


FIGURE 4. A reconstructed skull of *Australopithecus afarensis*.

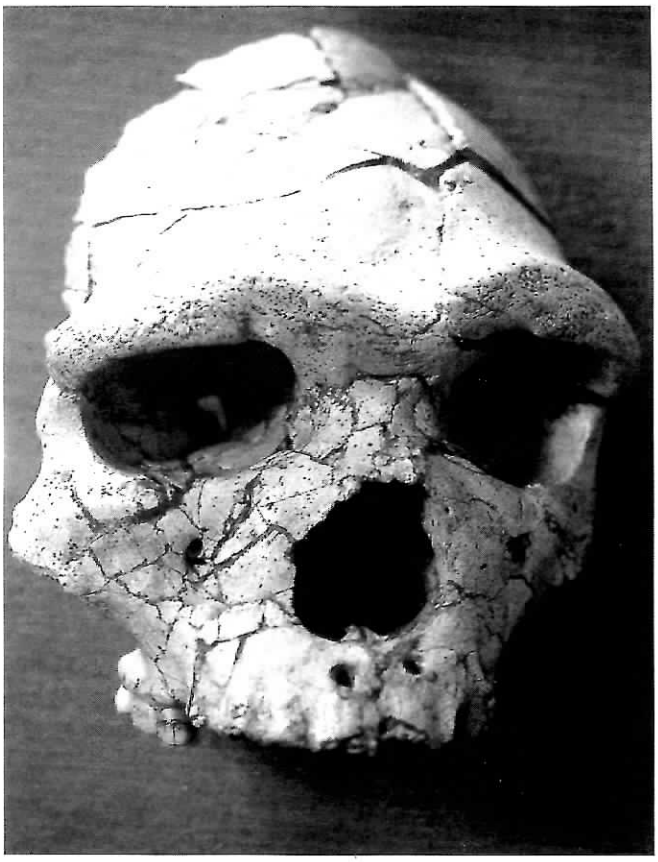


FIGURE 5. Early man presents a double curving, lateral and sagittal, of the nasoalveolar area as it can be observed in *Homo erectus* from Tautavel dated 0.45 Myr.

changes have increased what we call "balance index" of the head, the relation between two measures: the distance from the brain part basion-inion to the anterior buccal part basion-prosthion. The most forward point is incisive, so the incisors had to back up and the facial part to diminish. In this case the canine alveola grows more vertical to make place for the front teeth.

The study of australopithecine bones enabled us to determine the time when this adaptation took place. In 1986 the reconstruction of the upper jaw of *Meganthropus africanus*, Garusi hominid 1, acknowledged at the time as the oldest specimen of the species *A. afarensis,* clearly demonstrated the existence of two lines of descendants in the species. Its originality lies in an anatomical facial difference bound to the position of the canine on the dental arch when it erupts. The areas of bone resorption and addition turn the canine more or less vertical according to the species (*Figure 1*). Garusi happens to share the characteristics of this canine area with early *Homo* (*Table 1*). Here we observe that the canine alveola turns vertical without any lessening of the volume of the front teeth as it can be observed when the maxilla is placed on the mandible of *Homo habilis* Olduwai Hominid 7 (*Figure 2*). We find this less expanded premaxilla in *A. anamensis*, which takes back to 4 Myr the probable parting of *Homo* from *Australopithecus.*

TABLE 1. Distribution of dental characters among early hominids.

	Homo erectus	*M. africanus*	*A. afarensis*	*A. africanus*	*A. robustus*	*A. boisei*
Posterior megadontia	small	large	large	large	large	hyper
Upper canine size	large	large	large	intermediate	small	small
P^3 - asymmetric > P^4-	yes	yes	yes	no	no	no
Nasoalveolar projection	intermediate	intermediate	large	intermediate	small	small

Facial modifications are a necessary process for the widening of the brain area. Other leading actions are also necessary to obtain the useful brain competence. How can we distinguish what leads us to man? As a matter of fact, in the australopithecine forms said "robust", the canine also turns vertical (*Figure 3, A. africanus*). But in these species the volume of the incisors and canines has been diminishing and the anterior masseter origin is in a high position (*Figure 4*). The Garusi hominid (*Figure 2*) has been considered for a few years as belonging to the *A. afarensis* species because of some general features. Amongst these features is the double curve affecting the alveolo-dental area, that does not depend on the vertical position of the canine. Both features are found in early human species: *Homo habilis* and *Homo erectus* (*Figure 5*).

The molars of the various australopithecine species have grown bigger and bigger from the front part of the jaws to the back. An inverse situation is present in *Homo*. The 2 Myr of distinct development between Garusi and *Homo habilis* were necessary for the changes in skull to take place. Man therefore emerged as the representative of an evolving line independant from *A. afarensis* and later robust forms of australopithecines. These morphological changes concerning teeth and jaws, dating back to 4 Myr, are named "the dental lineage" identified by a large P^3 compared to P^4.

A NEW CONCEPT

We have found that language has no direct word corresponding to the emersion of man through animal nature. After discoveries of fossil species belonging to the human family, but possessing neither his skull development nor his genius, words coming from latin "homo" appeared (hominidae, hominid). But these neologisms have their place only in taxonomy (the Science of Classification) and do not express the profound nature of the question. In the same way the word "hominization", currently used since 1950, means the evolutionary development of human characteristics that differentiate man from his primate ancestors and does not point to the main characteristics of man himself. Probably because he felt this deficiency Teilhard de Chardin invented the words "hominisé" and "hominoïde", but both are not totally cleared from a phylogenetic connotation based on natural evolutionary relationships. So, we had to find a word whose characteristics would be proper to man only. For the animal we have "animality" (the animal nature), the essential nature of a god is "deity". Between god and animal, man should have his place with the word "hominity" which could be defined as all the characteristics proper to man, attaining to the beautiful formula of the philosopher "I think, so I am".

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